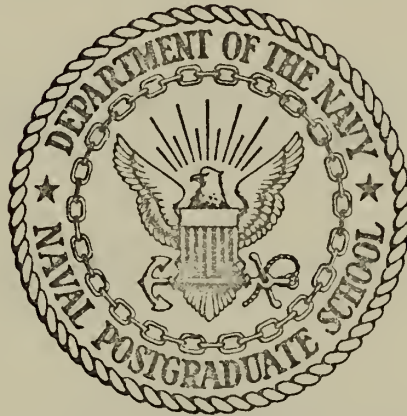


OPERATIONAL ANALYSIS OF
KOREAN DEFENSE EXPENDITURES

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NAVAL POSTGRADUATE SCHOOL

Monterey, California



THESIS

Operational Analysis
of
Korean Defense Expenditures

by

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September 1972

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Operational Analysis
of
Korean Defense Expenditures

by

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ABSTRACT

The huge size of the Korean defense budget and its armed forces have created a need for an operational analysis. It is shown through a multivariate statistical analysis what some of the opportunity costs of defense spending have been.

The Korea-U. S. alliance is discussed emphasizing developmental effects of U. S. aid.

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I. INTRODUCTION

This is a report about a central issue of Korean economics - expenditures for national defense. Korean military spending in 1970 reached a record 100 billion current Korean won; up 40 times since 1953 when The Bank of Korea compiled the first estimate of global military spending, based on National Income Statistics Yearbook. During this period, military outlays in current won have grown at the following rate; 2.5 billion won in 1953, 11 billion won in 1957, 20 billion won in 1962, 49 billion won in 1967, and 100 billion won in 1970.

Large armed forces have become a part of Korean life, as Korean as Kimchee.

Although it has the 22nd largest population among the world's people, Korea maintains the 6th largest armed forces on earth.

The arms race pattern of interaction between Korea and North Korea is widely regarded as the major reasons for Korean arms spending. Military expenditures provide a useful barometer of the momentum of the arms race. Figure I shows that the rate of expansion of defense expenditures was, by far, the sharpest for both sides during the last 8 years. North Korea spent 629 million dollars in 1968, while Korea spent 235 million dollars. Adding U. S. military assistance of 204 million dollars, the sum was still far below that of North Korea. This suggests that the Korean defense budgets might increase even more in the future.

TABLE I
DEFENSE RELATED DATA FOR KOREA AND NORTH KOREA

Field	Year	1964	1965	1966	1967	1968	1970	1971
Military Expenditures	N	300	350	300	460	628	746	849
Current (US \$ million)	K	123	113	150	184	235	335	425
GNP	N	2,500	2,500	2,900	3,000	3,500	3,000	3,420
Current Million US \$	K	2,745	2,901	3,822	4,612	5,730	8,300	10,200
Armed Forces	N	362	378	383	383	410	389	401
(1000 men)	K	600	604	572	612	620	597	634
Relative Defense (%)	N	12.0	14.0	10.3	15.3	18.0	24.9	25.0
Burden	K	4.5	5.6	3.9	4.0	4.1	4.0	4.0
Population	N	11.8	12.0	12.3	12.5	13.0	13.9	14.0
(million)	K	27.2	28.0	28.8	29.0	30.5	32.0	32.7

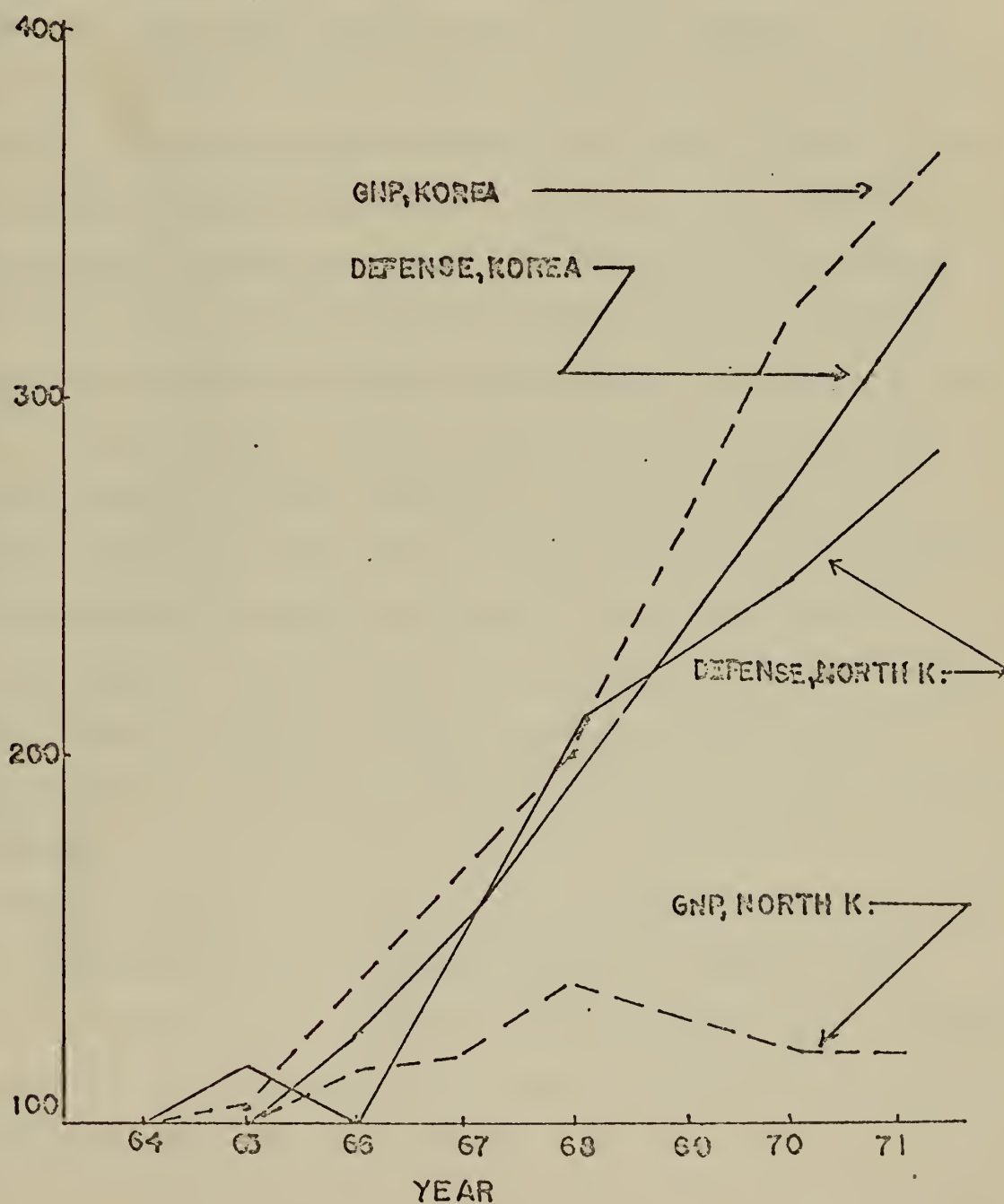
Above data was derived from the series of "Armed Forces of the World" by Robert C. Sellers.

FIGURE 1

MILITARY EXPENDITURES AND GNP ESTIMATE

IN CONSTANT PRICES INDEX, 1964=100

% INCREASE



It is reasonable to assume that defense spending has to come at the expense of something else. Alternatively, it is sometimes suggested that government expenditures such as defense, utilize resources that would otherwise be unemployed in the economy. This thesis will show which industry and factor of the economy are affected disproportionately from defense spending. Furthermore, it will enable us, in a sense, to do a cost benefit analysis of war or preparedness, and to identify the opportunity costs in the kind and amount of social benefits that are likely to be forgone. Thus the following assumptions are appropriate to precisely the kind of question relating to this study. If the civilian and military expenditures consistently compete for scarce resources, they will be highly negatively correlated. If they both are driven by the same factor, they will be positively correlated. If they generally compete but sometimes are viewed as complimentary, the negative correlation will be fairly low. By this criterion, one would hope to see periodic upswings in defense requirements financed largely out of personal consumption, with capital formation and such social investment in the public sector as health and education being insensitive to military demands. Another aspect of this criterion is the anticipation that in periods of declining military needs the released resources would be used for investment or education rather than returned to private consumption.

Fourteen sectors, or factors, of Korean economy, which are particularly concerned with military expenditures will be treated in this thesis. Various kinds of private and public expenditures were calculated as a proportion of GNP and these were then correlated with the proportion of GNP represented by defense spending.

Multivariate statistical methods were used. Further, statistical hypothesis testing methodology was used to determine if a strong relationship between the variables or between one variable and another set of variables existed. Partial correlation coefficients were compared with another set of correlation coefficients to see their dependence when the effect of another set of correlated variables has been removed. The next chapter, Chapter II, is a discussion of the opportunity costs of Korean defense. It is included to provide information on current and past research and to discuss some of the assumptions in the issues in defense economics relating to the model, in a specific application to the Korean defense. Chapter III contains a discussion of the economic value of alliances, since the Korean defense had a strong connection with U. S. The injection of 2.168 billion dollars of U.S. military assistance and the huge influx of U. S. economic aid, some 4.7 billion dollars, both over the period of 1946-1968, requires more analysis.

The final chapter contains a summary of this research effort and some suggested areas for future work.

II. THE BURDENS OF DEFENSE

In this chapter, the author shall examine information on expenditures by GNP categories, by function, and by governmental unit to see what kinds of alternative spending bear the brunt of military spending.

First, an overview of the changing level of defense expenditures in 1965 constant market prices may be helpful.¹ For 1953, in what was the Korean wartime year Korea has experienced, defense expenditures were over 39 billion won. After Korean War, they roughly decreased at the rate of 3.5% annually until they hit the minimum of 27 billion won in 1963. Defense expenditures started to rise rapidly, at the rate of 7.2% annually, after 1963. What an expenditure of this magnitude means, is clearer when it is measured against available economic resources. The value of Korean output had expanded at a fairly steady 5.1% annually until 1963. After 1963, during the period of First and Second Five-Year Economic Development Plan, Korea had a very rapid growth rate in GNP of 10.8% annually. The curve² which shows defense vs. year had the "V shape" with the minimum in 1963, while GNP had the property of monotonic increase over the whole time period. The reason for this relationship is that defense expenditures were decreasing until GNP reached 705 billion won in 1963. One other important property of defense expenditures during its decreasing

¹C. f. Table 1 and Table 2 in computer output for the following discussions.

²C.f. Variable 1 of Basic Data and Graph in computer output.

phase of the "V shape" (1953-1963) is that defense expenditures were decreasing absolutely in spite of the small rate of increase in GNP. This result can be viewed as due to a low priority within Korean economic development preference structure. When inspecting the graph of defense vs. GNP,³ defense expenditures were decreasing slowly until they hit 27 billion won, and GNP and defense were both increasing rapidly after that turning point. What this means becomes clearer when the ratio of defense to the GNP vs. GNP was inspected.⁴ The graph in this case, shows strictly decreasing relative burden of defense as a function of GNP. The relative burden of defense can be thought of as a price of defense to the nation as well as a demand for security, while GNP can be thought of as a level of income of the nation or its supply of resources. This graph suggests that when GNP was low, the nation suffered a heavy burden from defense spending, but a relatively lesser burden when GNP increased. It also shows that the relative demand for defense was inelastic. In discussing the defense burden the relative burden of defense expenditures as percentage of GNP is the most meaningful indicator. Looking at the graph⁵ which represents the yearly change in the ratio of defense to GNP, it suggests that before 1963, the ratio sharply decreased, while its decrease slowed down after 1963.

This means that the reordering of the nations resource allocation took place and defense expenditures were being emphasized at the expense

³ C.f. See that graph in computer output.

⁴ C.f. the graph next to the graph of defense vs. GNP in computer output.

⁵ C.f. the graph in computer output.

of other sectors of the economy. The correlation coefficient between defense and GNP was 0.5652 which was statistically significant at 5% level, while that between the ratio of defense to GNP and GNP was -0.7716 which was also statistically significant.⁶ Therefore, these facts suggest that Korea did not suffer a heavy rise in defense expenditures in terms of relative burden of defense, although the amount of defense spending increased in terms of won.

The most commonly used indicator for the purpose of relative burden of military expenditures, the ratio of military spending to GNP, is inadequate if used alone, and may be misleading. A major weakness of this ratio is that it fails to take account of the level of economic strength as represented by per capita incomes.

According to the Almanac of World Military Power in 1971,⁷ the estimated GNP of Korea was about 8.3 billion dollars, while the GNP of North Korea was 3.4 billion dollars. The relative burden of defense was 4% for Korea and 25% for North Korea. The per capita GNP for Korea was 254 dollars, while that of North Korea was 243 dollars in 1971. Both Korea and North Korea fell into the category of high spenders for military purposes in terms of relative burden of defense and per capita GNP among all the countries in the world.⁸

⁶ C.f. the correlation matrix in computer output. All the statistical tests on this thesis hereafter was based on 5% significance level.

⁷ Col. T. N. Dupuy, "The Almanac of World Military Power," pp. 257-274

⁸ Gerald C. Smith, "World Military Expenditures, 1970," United States Arms Control and Disarmament Agency, pp. 8.

Changes in GNP are the major explanatory factor for all variables except foreign aid. GNP had an almost linear relationships with the other variables except for defense expenditures which is nonlinear.

In chapter I, the author discussed the choice of variables which were alternative opportunities to military expenditures. To see the validity of the selections of variables, multiple correlation coefficients of various combinations were calculated and tested in Table II.

The test of hypotheses about multiple correlation coefficients suggest that military expenditures were highly correlated with all of the other set of variables.

The relationship between GNP and defense expenditures is of major interest in this thesis. The correlation coefficient between them was 0.5652. What interpretation is to be given to the apparent positive relationship between them?

Does high GNP tend to cause high defense expenditures or is high GNP associated with high defense expenditures? To answer this question, it is useful to consider the correlation between them while holding all other variables fixed; i.e., the partial correlation coefficient. If the effect of all other governmental expenditures is removed, GNP and defense are negatively correlated, i.e., $r_{1,2.3} = -0.4828$. The same effect results when holding investment effect fixed. When the effect of foreign aid was removed, the relationship between GNP and defense decreased, i.e., $r_{1,2.9} = 0.4413$. This suggests that foreign aid increased the relationship between GNP and defense.

TABLE II
MULTIPLE CORRELATION COEFFICIENT

MULTIPLE CORRELATION COEFFICIENT	BASIC	COMPOS
R1•2, 3, ..., 15	0.99209	0.99964
R1•12, 13, 14, 15	0.93860	0.99435
R1•2, 3, 4, 5	0.93286	0.97600
R2•4, 5, 7	0.99906	0.97605
R1•2, 7	0.96603	0.97314
R1•3,9	0.64333	0.94326
R2•5, 9	0.97304	0.94231
R2•10, 11	0.96809	0.97803

All the elements with significance at $\alpha = 0.05$ level i.e., for all the multiple correlation coefficient the hypothesis that there is no relationship between variables were rejected at the 5% of significance level.

Next to defense, the largest single outlay that government makes is for education as shown in Table I in computer output. Like the military budget, educational expenditures increased very rapidly during the last 18 years, 6.6% annually. However, it was still less than half of defense expenditures. Considering the rapid growth of the school-age population, expenditures for education was not much appreciably per pupil. The number of pupils at primary school was 5.55 million⁹ in 1969. This indicates Korean expenditures for public education was less than 3,600 won (less than 10 dollars) per primary school child, assuming all funds go to primary schools. The correlation coefficient between defense and education was 0.4023 which was statistically insignificant at 5% level and it was 0.3967 when both were measured in terms of the ratio to GNP. For both cases education had weak relationship between defense, but nonetheless important. A widespread assumption holds that public expenditures on education have experienced a long-term secular growth in Korea. That assumption is correct only with modifications. The proportion of GNP devoted to public education has roughly increased until 1962, but rapidly decreased thereafter from 2.0% in 1962 to 1.5% in 1970. One interesting fact is that this decreasing part coincides with that of rapidly increasing part of defense expenditures. This fact supports the results that the reordering of resource allocation took place at that time. Public expenditures for education seemed to be insensitive to the pressures of defense, since the correlation coefficients between them were as low as 0.4023. However, if the effect of GNP or government expenditures was removed, then defense and education

⁹ Economic Planning Board, "The System of Korean Government" Pamphlet-1, 1970, Table 23, "The increase rate of pupils and teachers."

competed for limited resources, i. e., $r_{1,14.2} = -0.902$ and $r_{1,14.3} = -0.7602$. Thus the sensitivity of educational expenditures to military need is much more marked in terms of partial correlation coefficients.

For all publicly supported health care, the Korean government paid out an estimated 1.05 billion won in 1970, or one-fiftieth as much as defense spending. For all Koreans, this amount spent for health care averaged out to almost nothing. The simple correlation coefficient between defense and health care was 0.5985 which was significant. However, the correlation coefficient in terms of the ratio to GNP between them was -0.8062. Thus public health care was more sensitive to the pressures of defense than education. This can be interpreted to suggest that education was preferred to public health care in Korea. Accordingly, it seems fair to conclude from the above, that increasing defense spending has hampered the nation in its attempt to build a healthier citizenry.

The correlation coefficient between recreation and defense was -0.9558, in terms of ratio to GNP. It suggests that Korea did not give much attention to this side, and that expenditures for recreation were the least preferred among all the sectors of Korean economy.

Korean armed forces were estimated at about 634,400 men in 1971. The ratio of armed forces to population was 2%. When compared with the economically active male population, in 1971, the level of armed forces was really significant, one man out of every 10 economically active men.

A nation's international balance of payments is often a major casualty of sharp increases in military expenditures; the Korean situation is not unusual. Some potential exports are diverted to

satisfy internal demand. Others are lost because domestic inflation raises costs to the point that the goods are priced out of the world market. In 1970, Korea imported 540 billion won worth of goods, while exporting 228 billion worth of goods. Over the period of this survey, the correlation between them was 0.9803, which was statistically significant. The correlation coefficient between defense and export was 0.7230, while 0.7427 for import; both were statistically significant. This suggests that Korean defense depends on foreign exchange, especially in imports.

The correlation between private consumption expenditures and defense expenditures was highly positive. This suggests that both were increased by the same factor, GNP. Private consumption has indeed been the largest alternative use of defense money. This fact can be explained using partial correlations. Thus, $r_{14} = 0.5131$, $r_{14.2} = -0.7526$, $r_{14.3} = -0.7376$, $r_{14.9} = 0.3634$. These relationships mean that for fixed GNP or fixed government expenditures, the defense was really competing with private consumption expenditures. The effect of foreign aid turned out to be crucial, in the sense that foreign aid smoothed the competition between defense and private consumption expenditures. The defense expenditures roughly decreased at the rate of 3.5% annually from 1953 to 1963. During that time, private consumption expenditures increased 5% annually. Considering the ratio to GNP, it was the most inelastic among any sectors of the economy, but it roughly decreased annually.

The correlation coefficient between defense spending and investment, in terms of percentage of GNP was -0.5423. What it means is that Korea continued to shift more money to investment from defense spending. When compared with private consumption expenditures, the correlation was -0.9170, in terms of percentage of GNP. Furthermore, when inspecting the data and the correlation matrix in the computer output, the investment was highly negatively correlated with government expenditures, education, as well as private consumption and defense expenditures in terms of percentage of GNP. One more important fact is that investment was the only factor which increases yearly, in terms of a percent of GNP among those above. Combining those results, it can be concluded that investment was the most preferred sector of Korean economy.

The level of government expenditures defines the level of requisite tax burden. In this context, increase in defense expenditures caused an increase in taxation, thus the highly positive correlation between government expenditures and defense resulted. Expanded defense needs are usually financed by a combination of increased taxation and deficit spending. Bank notes and coin issued in each year during the last ten years, were approximately the same amount as the defense expenditures.¹⁰ The high level of government expenditures appears to be the prime reason for inflation. Multiple regression coefficients show the joint relationship of defense to a set of variables of GNP, government expenditures, private expenditures and investment.¹¹ This suggests that defense

¹⁰ The Bank of Korea, "Economics Statistics Yearbook 1971," pp. 92, the correlation coefficient between them was 0.955.

¹¹ C.f. the last page of computer output.

expenditures can be predicted as a linear combination of the above four variables. Thus the increase in one dollar for each sector is associated with changes in defense expenditures as follows; 10 cents for GNP, 64 cents for government expenditures, -19 cents for private consumption expenditures, -1 cent for investment. The result can be written as a regression equation;

$$\text{Defense Expenditures} = 26.5 + 0.1 (\text{GNP}) + .64 (\text{Government Expenditures}) - .19 (\text{Private Consumption Expenditures}) - .01 (\text{Investment}).$$

This completes the development of the model required to describe the burden of defense.

III. THE ECONOMIC VALUE OF ALLIANCES

The Korea-U. S. Alliance can be thought of as a collective good. The U.S. extends an umbrella to cover Korea from communist attack, and at the same time, augments its own forces by the extent of the Korean defense effort. After the Korean War, the number of U. S. troops in Korea remained roughly the same. From 1954 until 1970 there were two divisions of varying strength. Today, operational control of all the Korean troops is exercised by the Commanding General, U. S. Eighth Army, who concurrently holds the post of Commander of the U. S. Forces in Korea. In a military alliance, the collective good aspect remains important. The small country will feel able to relax its own efforts, because it has obtained the protection of a great power. The U. S. may indeed want to limit the credibility of its assurances, since they carry a risk of involvement in a major war for the sake of Korean objectives, that may be trivial for the U.S.

The U. S. commitment to the defense of Korea was formally embodied in the 1954 Mutual Defense Agreement and in repeated assurances by various presidents and through numerous U. S. officials. The treaty, however does not commit either country to go to war if the other is invaded, but seeks to provide a less firm commitment. This obscurity may give some confidence to North Korea and some doubt to Korea. Moreover, the U. S. withdrew one division in 1971, and again withdrew the lone U. S. Division guarding the 18 mile stretch of the D. M. Z. and turned the defense of the entire 155 mile boundary over to the Korean Army. The U. S. now has the additional time to decide whether or not to

commit its ground forces after the start of hostilities. Consequently, withdrawals of these kinds increased the doubt over the U. S. commitment and stimulated the defense budget of Korea in 1971.¹²

Senator George McGovern stated "Asia is seen as having only a marginal bearing on vital American interests."¹³ In spite of 157,530 lives and about 5 billion dollars which had already gone to Korea, the U. S. still intends retrenchment in its foreign affairs with regard to Korea.

As Olson and Zechauser pointed out, it is reasonable to assume that the larger the nation, the more disproportionate the share of the total military cost it will bear, and the failure of burden sharing would thus indicate the success of deterrence. In reality, the deterrence provided in the Defense Treaty, successfully aided Korea in achieving two Five-Year Economic Development Plans without large defense expenditures.

Regrettably, many countries must strive to make economic and social progress while carrying a heavy burden of defense, and military needs compete with development projects for limited resources.

¹² The defense budget in 1971 was 134 billion won in current prices which was 27.2% increase from 1970.

¹³ U. S. Senator George McGovern "Toward a More Secure America - an Alternative National Defense Posture", pp. 24.

Looking at Figure II, U. S. military assistance as a percent of Korean military expenditures was 282% in 1958 and 122% in 1967, averaging 180% over 13 years.¹⁴ How can Korea maintain a large military establishment and at the same time, finance rapid developments without U. S. aid?

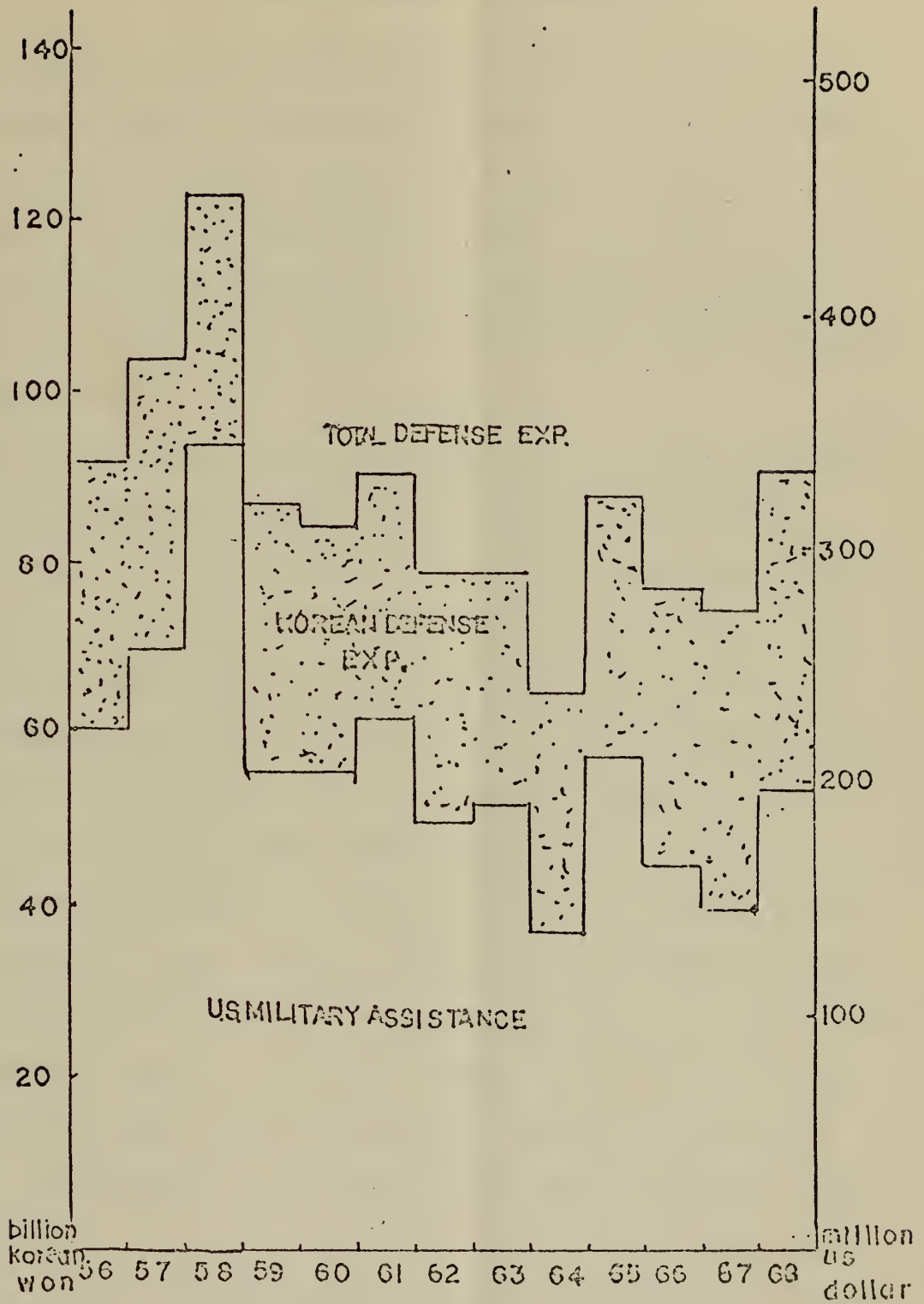
To make measurements of the military burden of the Korean economy, it is necessary to evaluate the U. S. aid.

Did military assistance have developmental effects? The answer turns primarily upon whether the Korean government resources and U. S. aid were tangible, and what would have been the reactions of the Korean government to a withdrawal of military budget support. Given a resource constraint, if the Korean government had raised taxes to make up part of the loss which might come from elimination of military assistance, it is likely that a major part of these taxes would have reduced private savings and investment. In these circumstances, the primary effect of military budget support, was to make available more Korean resources for development.

The correlation coefficient between defense expenditures and foreign aid was -0.3950. This suggests that high defense spending was associated with low foreign aid and the correlation was statistically not significant. Partial correlation coefficients were as follows; $r_{19.2} = 0.014$, $r_{19.3} = 0.027$, $r_{19.5} = 0.149$. These suggest that, for fixed GNP or government expenditures or investment, defense expenditures were independent of foreign aid. Foreign aid was negatively correlated with GNP with coefficient -0.7134. Furthermore, this fact can be interpreted to suggest that increases in GNP lead to decreases in foreign aid after 1957.

¹⁴ Correlation coefficient between defense and military assistance was 0.226, regression coefficient was 0.048 for simple regression.

FIGURE II
MILITARY ASSISTANCE



IN 1965 CONSTANT MARKET PRICES
(1 US DOLLAR = 272.60 KOREAN WON)

IV. SUMMARY AND AREAS FOR FURTHER STUDY

In summary, it has been shown that the burden of defense can be interpreted in terms of the opportunity costs of the kind and amount of social benefits that are likely to be forgone. In large part, the burden of a big defense budget has been thrust onto Korea by the demands of the arms race with North Korea. Past fluctuations in defense and civilian need indicate what some of the opportunity costs of defense spending have been.

The Korean economic standard of living, in real terms, has shown a significant improvement during the past 8 years, after the Third Republic began. The diversion of resources to military purposes has expanded in accordance with the Korean capacity to produce after 1963.

On the requirement that defense upswings be financed largely out of private consumption as well as sacrificing public expenditures for education and health care, part of the growth dividend since 1963 has been dissipated in higher defense expenditures, rather than contributing to the improvement of the nation's welfare. However, in spite of increasing per capita defense expenditures, the burden of defense has been reduced during the entire period of study, since GNP per capita increased more rapidly. One result, however, is that in that period of declining military needs, the released resources be allocated largely for consumption and education first, and then switched largely for investment. It suggests that educational needs apparently could not be sacrificed or postponed when military needs were great, although the amount of expenditures was far less than that of defense purposes.

During the entire period of survey, investment's share of the GNP was the only factor which was continuously rising among the sectors of the economy. Combining with continuously decreasing relative defense spending, this drop in relative defense spending has perhaps enabled investment to rise. In the long run, a nation's strength depends on a continuing high level of investment. In this sense, Korean economic policy achieved great success in concentrating its efforts on investment, rather than for defense, so that Korea has become the model case for developing countries.

Alliances in the form of U. S. military and economic aid, not only proved successful in its deterrence effect, but also provided a means for allowing Korea to make available more resources for development projects.

There are several areas which seem suitable for further study. First, statistical estimation procedures should be applied within a linear regression model and indicate the amount in dollars by which an item of civilian spending changes in response to a one-dollar increase or decrease in defense. Second, defense expenditures are not necessarily without social utility. The positive effects of military establishment were not discussed here. These effects could be developed further, as well as the social value of defense. A third area for study is the regional impact of military spending. This area needs a higher degree of data and more information about the geographical distribution of the military establishment. Finally, the model could be extended to more detailed subcategories of the economy. This would involve some method of classifying the sectors of Korean economy.

Past opportunity costs in Korea do not provide a perfect guide or deterministic mold for the future. Both the political system and the economy change. Should it be concluded, after enlightened discussion, that certain new defense needs must be met, it is possible, by careful choice and control, to distribute the burden of defense somewhat differently.

APPENDIX

MULTIVARIATE STATISTICAL ANALYSIS TO THE DEFENSE EXPENDITURES

The mathematical model on which this analysis is based is multivariate Normal distribution or a combination of multivariate Normal distributions. The main justification for studying methods relating to the Normal distribution so intensively, is that this mathematical model is suitable for such a large number of cases, when multiple measurements are treated.

In this case, as well as a host of others in econometrics, the multivariate Normal distributions have been found to be sufficiently close approximations to the true population, so that statistical analysis based on these models are justified. Another reason for confining this study to considerations of Normal theory is that multivariate methods based on the Normal distribution are extensively developed, and can be studied in a rather organized and systematic way.

The Basic Data¹⁵ is a rectangular matrix denoted "A". It is composed of 270 elements. That is, 18 observation for every 15 variables.

$$A = (a_{ij}), \quad \begin{array}{l} i = 1, 2, \dots, 18 \\ j = 1, 2, \dots, 15 \end{array}$$

Each column represents the variables which are indexed by j , $j = 1, 2, \dots, 15$ as follows:

1. defense expenditures
2. GNP
3. government consumption expenditures
4. private consumption expenditures

¹⁵ All the data and statistical analysis appeared in computer output.

5. total investment
6. wholesale price index, 1965=100
7. population in millions
8. exchange rate of Korean won to U. S. dollars
9. foreign aid
10. export
11. import
12. public administration and defense products
13. recreation and entertainment
14. education
15. sanitary services

All the data, except for population and foreign aid, came from "National Income Statistics Yearbook 1971" by The Bank Of Korea, and population and foreign aid came from "Economic Statistics Yearbook 1971" by The Bank of Korea.

All amounts were measured in billion Korean won of the 1965 constant market value, except for variables 6, 7 and 8. Variables 1 and 3 were adjusted to constant market prices in 1965 as follows:

$$\frac{\text{amount in constant market prices in 1965}}{\text{price deflator for government spending}} = \frac{\text{amount at current market prices}}{\text{price deflator for government spending}}$$

Variables 9, 10 and 11 were adjusted as follows:

$$\frac{\text{amount in constant market prices in 1965}}{\text{price deflator for government spending}} = \frac{\text{Amount in dollars}}{1965} \times \text{exchange ratio in 1965}$$

This calculation assumed that the value of U. S. dollars changed insignificantly, when compared with change in won value.

Each row number represents the corresponding year which is indexed by i , $i = 1, 2, \dots, 18$

$$\text{Year} = \text{row index} + 52$$

e.g. For 1st row: $1 + 52 = 53$, i.e., the data in 1953.

Therefore, this survey covered the period of 18 years, from 1953 to 1970.

The Composition Data is a rectangular matrix denoted "B". It is composed of 270 elements, and it was derived as follows:

$$b_{ij} = \frac{a_{ij}}{a_{i2}} \times 100, \quad \begin{array}{l} i = 1, 2, \dots, 18 \\ j = 1, 2, \dots, 6, 15, \quad j \neq 2, 6, 7, 8. \end{array}$$

$$B = (b_{ij}), \quad \begin{array}{l} i = 1, 2, \dots, 18 \\ j = 1, 2, \dots, 15 \end{array}$$

Since the variables 2, 6, 7 and 8 were not transformed, they are the same numbers as those in Basic Data. The method of maximum likelihood was used to a large extent, since it leads to reasonable procedures, and it gives unbiased estimates of some important parameters.

First, to see how much Korea had spent for some variables during the last 18 years, the total sum of the amounts were calculated. In statistics, central value refers to the location of the center of the distribution and it gives the general behavior of some variables. This is shown next to the sums in computer output.

The cross-product deviations, variance-covariance matrix, and the standard deviations of each variable was shown, to see how the observations were spread out from the average.

The purpose of this analysis, is to predict the dependence between variables. The notion of correlation coefficient was expanded to multiple correlation and partial correlation, to see the dependence between one variable and another set of variables, and the dependence

when the effect of other correlated variables have been removed, respectively. Cross-tabulation plots of any two variables were scaled to 50x100 character spaces or units, by computer, to identify how two variables were related to each other visibly.

Null hypothesis about the simple correlation coefficient, was that a pair of variables were not correlated. To test this hypothesis, t - statistics were used with significance level of 5% and power of test as 90%. The confidence interval for this test was (-0.4683, 0.4683). Null hypothesis about the multiple correlation coefficient, was that there is no relationship between one variable and another set of variables. To test this hypothesis, F - statistics were used with significance level of 5% and power of test as 90%. Multiple regression shows the joint relationship of defense expenditures to a set of variables of GNP, government expenditures, private expenditures and investment. T values were computed and tested for 99.9% of confidence interval. All the t - values were accepted. F value was computed and tested for the independence of denominator and numerator. This test resulted in a significant deviation from regression at 5% of significance level.

1. BASIC DATA

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.	39.68	421.93	60.14	361.79	69.56	12.00	20.20	18.00	52.88	10.79	94.15	46.56	0.08	7.51	0.12
2.	37.22	447.36	58.81	381.05	57.87	15.40	20.80	18.00	41.71	6.60	66.32	43.52	0.24	8.95	0.10
3.	33.52	474.54	61.09	422.89	61.34	27.80	21.40	50.00	64.33	4.91	93.07	43.03	0.38	9.91	0.11
4.	31.14	480.47	65.73	444.85	57.29	36.60	22.30	50.00	89.14	6.70	105.25	41.58	0.59	10.51	0.17
5.	34.13	552.73	66.34	471.32	87.91	42.50	22.90	50.00	104.41	6.05	120.54	39.52	0.79	10.82	0.17
6.	33.48	551.69	70.52	486.05	77.72	39.90	23.60	50.00	87.50	4.50	103.10	37.06	1.16	11.04	0.18
7.	31.11	575.84	69.84	508.55	57.83	40.80	24.30	50.00	60.52	5.40	82.82	36.48	1.56	11.32	0.19
8.	28.64	585.07	71.13	523.30	62.48	45.20	25.00	65.00	66.79	8.94	93.64	36.06	1.60	11.60	0.30
9.	28.26	613.61	69.84	528.33	72.95	51.20	25.70	130.00	54.25	11.15	86.17	35.70	1.70	12.22	0.28
10.	29.06	634.97	70.44	568.96	77.99	56.00	26.40	130.00	63.24	14.94	114.98	36.96	2.39	12.88	0.31
11.	27.13	693.03	73.84	587.74	137.27	67.50	27.20	130.00	58.88	23.66	152.74	38.24	3.01	13.98	0.32
12.	28.17	750.31	71.18	620.44	114.41	90.90	27.90	256.50	40.62	32.67	110.24	38.88	3.40	14.76	0.32
13.	29.71	805.85	76.02	669.08	118.48	100.00	28.70	272.60	35.71	47.73	126.32	39.94	4.18	15.81	0.41
14.	32.35	913.82	84.76	716.99	207.38	108.80	29.40	271.50	28.08	68.23	195.29	42.21	4.49	17.16	0.34
15.	34.50	995.16	93.42	783.92	241.72	115.80	30.00	274.60	26.44	87.29	271.56	45.78	5.20	18.00	0.63
16.	38.48	1127.32	105.64	873.58	344.12	125.20	30.70	281.50	28.90	124.14	398.79	48.23	5.70	19.20	0.71
17.	43.61	1306.19	118.53	969.91	451.47	133.70	31.40	304.40	29.17	169.69	497.11	50.25	6.39	20.40	0.92
18.	44.89	1422.33	126.48	1077.16	433.94	145.90	32.00	316.60	22.35	227.68	540.84	52.65	7.03	21.87	1.05

2. COMPOSITION TO GNP IN % EXCEPT FOR VARIABLES 2,6,7,8

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.	9.404	421.930	14.254	85.746	16.486	12.000	20.200	18.000	12.533	2.557	22.314	11.035	0.019	1.780	0.028
2.	8.320	447.360	13.146	85.177	12.936	15.400	20.800	18.000	9.324	1.475	14.825	9.728	0.054	2.001	0.022
3.	7.064	474.540	12.874	89.116	12.926	27.800	21.400	50.000	13.556	1.035	19.613	9.068	0.080	2.088	0.023
4.	6.481	460.470	13.680	92.586	11.924	36.600	22.300	50.000	18.553	1.394	21.906	8.654	0.123	2.187	0.035
5.	6.175	552.730	12.002	85.271	15.905	42.500	22.900	50.000	18.890	1.095	21.808	7.150	0.143	1.958	0.031
6.	6.069	551.690	12.783	88.102	14.088	39.900	23.600	50.000	15.860	0.816	18.688	6.718	0.210	2.001	0.033
7.	5.403	575.840	12.128	88.314	10.043	40.800	24.300	50.000	10.510	0.938	14.382	6.335	0.271	1.966	0.033
8.	4.862	589.070	12.075	88.835	10.607	45.200	25.000	65.000	11.338	1.518	15.896	6.122	0.272	1.969	0.051
9.	4.606	613.610	11.382	86.102	11.889	51.200	25.700	130.000	8.841	1.817	14.043	5.818	0.277	1.991	0.046
10.	4.577	634.970	11.093	89.604	12.282	56.000	26.400	130.000	9.960	2.353	18.108	5.821	0.376	2.028	0.049
11.	3.915	693.030	10.655	84.807	19.807	67.500	27.200	130.000	8.496	3.414	22.039	5.518	0.434	2.017	0.046
12.	3.754	750.310	9.487	82.691	15.248	90.900	27.900	256.500	5.414	4.354	14.693	5.182	0.453	1.967	0.043
13.	3.687	805.850	9.434	83.028	14.702	100.000	28.700	272.600	4.431	5.923	15.675	4.956	0.519	1.962	0.051
14.	3.540	913.820	9.275	78.461	22.694	108.800	29.400	271.500	3.073	7.466	21.371	4.619	0.491	1.878	0.037
15.	3.467	995.160	9.387	78.773	24.290	115.800	30.000	274.600	2.657	8.771	27.288	4.600	0.523	1.809	0.063
16.	3.413	1127.320	9.371	77.492	30.525	125.200	30.700	281.500	2.564	11.012	35.375	4.278	0.506	1.703	0.063
17.	3.339	1306.190	9.074	74.255	34.564	133.700	31.400	304.400	2.233	12.991	38.058	3.847	0.489	1.562	0.070
18.	3.156	1422.330	8.892	75.732	30.509	145.900	32.000	316.600	1.571	16.008	38.025	3.702	0.494	1.538	0.074

8MD02D CORRELATION WITH TRANSGENERATION - REVISED JANUARY 29, 1970
HEALTH SCIENCES COMPUTING FACILITY,UCLA

PROBLEM CODE 8MD02D
NUMBER OF VARIABLES 15
NUMBER OF CASES 18

VARIABLE FORMAT CAFD (S)
(8F10.2)

REMAINING SAMPLE SIZE= 16 , BASIC DATA

SUMS

605.0789 13356.1953 1413.7453 10995.8828 2731.7290 1255.1992 469.8994 2718.6995
954.9185 861.0656 3252.9280 752.6489 49.8900 247.9399 6.6300

MEANS

33.6155 742.0137 78.5415 610.8823 151.7627 69.7333 26.1055 151.0388
53.0510 47.8372 180.7162 41.8138 2.7717 13.7744 0.3683

GROSS PRODUCT DEVIATIONS

	COL. 1	COL. 2	COL. 3	COL. 4	COL. 5	COL. 6	COL. 7	COL. 8
ROW								
1	476.6790	15163.9141	1145.3555	9373.1914	8369.6484	1426.6936	78.4760	2903.2283
2	15163.9141	150960.0000	96581.5030	1024779.6875	642109.5625	207482.2500	17727.0586	519598.3125
3	1145.3555	98881.5000	6656.0977	76703.0625	43125.2300	12997.5273	1100.8245	31252.9922
4	9373.1914	1024779.6875	66723.9375	700098.9375	429143.2500	142177.0000	12292.3789	355957.2500
5	8369.6484	642109.5625	43125.2300	429143.2500	283983.5000	83931.3438	6935.5586	204335.4375
6	1426.6936	207482.2500	12997.5273	142177.0000	6935.5586	30731.3438	2662.1611	79995.3350
7	78.4760	519598.3125	31252.9922	355957.2500	204335.4375	2685.1611	241.9920	6955.3359
8	2903.2283	519598.3125	31252.9922	355957.2500	204335.4375	2685.1611	241.9920	6955.3359
9	519598.3125	31252.9922	355957.2500	204335.4375	204335.4375	2685.1611	241.9920	6955.3359
10	31252.9922	355957.2500	204335.4375	204335.4375	204335.4375	2685.1611	241.9920	6955.3359
11	355957.2500	204335.4375	204335.4375	204335.4375	204335.4375	2685.1611	241.9920	6955.3359
12	204335.4375	204335.4375	204335.4375	204335.4375	204335.4375	2685.1611	241.9920	6955.3359
13	204335.4375	204335.4375	204335.4375	204335.4375	204335.4375	2685.1611	241.9920	6955.3359
14	204335.4375	204335.4375	204335.4375	204335.4375	204335.4375	2685.1611	241.9920	6955.3359
15	204335.4375	204335.4375	204335.4375	204335.4375	204335.4375	2685.1611	241.9920	6955.3359

	COL. 1	COL. 2	COL. 3	COL. 4	COL. 5	COL. 6	COL. 7	COL. 8
ROW								
1	-847.1189	4228.8947	9844.6250	418.8862	83.9788	14.9795	15.0340	COL.
2	4228.8947	318690.3750	709861.1250	17831.1250	1118.1737	20545.0035	1393.2144	COL.
3	9844.6250	709861.1250	486028.4375	11243.7710	7611.7930	14001.2500	941.2070	COL.
4	418.8862	17831.1250	90137.8281	20137.8281	1609.0923	8404.6933	594.9281	COL.
5	83.9788	83.9788	135.1265	135.1265	1405.3125	7539.3340	452.8689	COL.
6	14.9795	20545.0035	5019.8984	5019.8984	4155.3125	7539.3340	452.8689	COL.
7	15.0340	1393.2144	-35878.1250	-4228.2734	-690.3916	-111.8637	-75.8436	COL.
8	318690.3750	486028.4375	159423.1250	10477.8516	2243.2999	9.145.7832	298.8770	COL.
9	709861.1250	486028.4375	10477.8516	447.7601	114.7601	157.1793	17.1096	COL.
10	418.8862	20137.8281	90137.8281	20137.8281	1609.0923	8404.6933	594.9281	COL.
11	83.9788	83.9788	135.1265	135.1265	1405.3125	7539.3340	452.8689	COL.
12	14.9795	20545.0035	5019.8984	5019.8984	4155.3125	7539.3340	452.8689	COL.
13	15.0340	1393.2144	-35878.1250	-4228.2734	-690.3916	-111.8637	-75.8436	COL.
14	318690.3750	486028.4375	159423.1250	10477.8516	2243.2999	9.145.7832	298.8770	COL.
15	709861.1250	486028.4375	10477.8516	447.7601	114.7601	157.1793	17.1096	COL.

STANDARD DEVIATIONS

5.2953 298.0288 19.7872 202.9342 130.8413 42.5174 3.7729 113.4488
23.8248 64.9773 147.2597 5.1327 2.2476 4.1418 0.2790

VARIANCE-COVARIANCE MATRIX FOR BASIC DATA

ROW	COL. 1	COL. 2	COL. 3	COL. 4	COL. 5	COL. 6	COL. 7	COL. 8
1	28.0399	891.9949	67.3738	551.3640	3771.4284	1204.8939	1042.7681	170.7881
2	51.7138	5969.9103	391.5212	6028.1163	2232.7784	833.7032	1021.6814	3056.4401
3	50.9398	6777.1123	391.5212	4328.4738	1717.4453	833.7032	797.9779	2093.7305
4	50.9398	1204.2764	762.7544	323.3116	490.7031	107.5977	156.5977	1018.7308
5	17.7181	1818.4111	1818.4111	2093.6022	407.7339	475.5977	142.2348	40.0589
6	19.9305	3065.2500	125.4772	2399.6022	12013.3205	475.5977	409.1328	127.6350
7	19.9305	1818.4111	1818.4111	2399.6022	12013.3205	475.5977	409.1328	127.6350
8	19.9305	1818.4111	1818.4111	2399.6022	12013.3205	475.5977	409.1328	127.6350
9	19.9305	1818.4111	1818.4111	2399.6022	12013.3205	475.5977	409.1328	127.6350
10	19.9305	1818.4111	1818.4111	2399.6022	12013.3205	475.5977	409.1328	127.6350
11	19.9305	1818.4111	1818.4111	2399.6022	12013.3205	475.5977	409.1328	127.6350
12	19.9305	1818.4111	1818.4111	2399.6022	12013.3205	475.5977	409.1328	127.6350
13	19.9305	1818.4111	1818.4111	2399.6022	12013.3205	475.5977	409.1328	127.6350
14	19.9305	1818.4111	1818.4111	2399.6022	12013.3205	475.5977	409.1328	127.6350
15	19.9305	1818.4111	1818.4111	2399.6022	12013.3205	475.5977	409.1328	127.6350

CORRELATION MATRIX FOR BASIC DATA

ROW	COL. 1	COL. 2	COL. 3	COL. 4	COL. 5	COL. 6	COL. 7	COL. 8
1	1.0000	0.5620	0.6433	0.5137	0.7106	0.3728	0.2311	0.2843
2	0.5620	1.0000	1.0000	0.9883	0.9798	0.9681	0.8674	0.8990
3	0.6433	1.0000	1.0000	0.9883	0.9798	0.9681	0.8674	0.8990
4	0.5137	0.9883	0.9883	1.0000	0.9798	0.9681	0.8674	0.8990
5	0.7106	0.9798	0.9798	0.9798	1.0000	0.9681	0.8674	0.8990
6	0.3728	0.9681	0.9681	0.9681	0.9681	1.0000	0.8674	0.8990
7	0.2311	0.8674	0.8674	0.8674	0.8674	0.8674	1.0000	0.8990
8	0.2843	0.8990	0.8990	0.8990	0.8990	0.8990	0.8990	1.0000
9	0.9500	0.7230	0.7427	0.9066	0.4134	0.4023	0.5985	0.5985
10	0.9500	0.9500	0.9500	0.9500	0.9500	0.9500	0.9500	0.9500
11	0.9500	0.9500	0.9500	0.9500	0.9500	0.9500	0.9500	0.9500
12	0.9500	0.9500	0.9500	0.9500	0.9500	0.9500	0.9500	0.9500
13	0.9500	0.9500	0.9500	0.9500	0.9500	0.9500	0.9500	0.9500
14	0.9500	0.9500	0.9500	0.9500	0.9500	0.9500	0.9500	0.9500
15	0.9500	0.9500	0.9500	0.9500	0.9500	0.9500	0.9500	0.9500

BMD02D CORRELATION WITH TRANSGENERATION - REVISED JANUARY 29, 1970
HEALTH SCIENCES COMPUTING FACILITY, UCLA

PROBLEM CODE BMD02D
NUMBER OF VARIABLES 15
NUMBER OF CASES 18

ARIABLE FORMAT CARD (S)
(10F8.3)

REMAINING SAMPLE SIZE= 18 , COMPOSITION DATA
SUMS

	91.2319	13359.1953	200.9919	1514.0903	321.4246	1255.1992	469.8994	2718.6995
	159.8039	84.9369	394.1064	113.1509	5.7340	34.4049	0.7980	
MEANS								

	5.0684	742.0107	11.1662	84.1161	17.8569	69.7333	26.1055	151.0388
	8.8780	4.7187	21.8948	6.2862	0.3186	1.9114	0.0443	

CROSS PRODUCT DEVIATIONS

ROW	COL. 1	COL. 2	COL. 3	COL. 4	COL. 5	COL. 6	COL. 7	COL. 8
1	57.4385	-7186.1445	51.2653	-23884.3696	-177.9321	-1155.3884	-110.5205	-3024.6997
2	-7186.1445	1509960.0000	-7734.5977	98.3696	346.1523	207482.2292	1777.0588	519558.3125
3	51.2653	-7734.5977	32.4093	123.5395	-137.8438	-17214.7444	-159.8188	-3228.7109
4	98.3696	98.3696	128.4336	467.5169	-98.9601	-3271.5444	372.8119	11158.3594
5	-7186.1445	1509960.0000	-7734.5977	-617.9601	459.0641	30731.5438	292.9103	79682.3350
6	-7186.1445	1509960.0000	-7734.5977	-370.4444	459.0641	30731.5438	292.9103	79682.3350
7	-7186.1445	1509960.0000	-7734.5977	-272.8110	11138.0803	2662.6151	655.9359	218959.9839
8	-7186.1445	1509960.0000	-7734.5977	-8628.1109	11138.0803	2662.6151	655.9359	218959.9839
9	-7186.1445	1509960.0000	-7734.5977	-419.6885	11138.0803	2662.6151	655.9359	218959.9839
10	-7186.1445	1509960.0000	-7734.5977	-319.9708	526.5649	3118.7041	309.2729	8959.7269
11	-7186.1445	1509960.0000	-7734.5977	-123.3077	-160.5481	4012.5083	-17.8161	-3447.1177
12	-7186.1445	1509960.0000	-7734.5977	-11.3391	-19.2810	118.1422	11.0950	317.8843
13	-7186.1445	1509960.0000	-7734.5977	-0.9717	-19.2810	118.1422	-7.2838	-24.5142
14	-7186.1445	1509960.0000	-7734.5977	-0.9717	-19.2810	118.1422	-7.2838	-24.5142
15	-7186.1445	1509960.0000	-7734.5977	-0.9717	-19.2810	118.1422	-7.2838	-24.5142

STANDARD DEVIATIONS

1	123.7772	-94.6637	11.8569	64.4672	13.3478	14.304	15.3936	15.3936
2	-23084.3789	23082.6367	32860.6484	-8693.9648	-5.3478	-734.7036	-70.4008	-70.4008
3	145.4701	-111.5732	-116.4342	58.7202	-5.1851	3.0280	0.3730	0.3730
4	419.6687	-379.7908	943.5649	120.5481	14.2710	13.4391	-0.9717	-0.9717
5	-499.1587	556.5779	3118.7041	-1343.5622	11.0950	-89.7289	9.8109	9.8109
6	-306.9263	257.3328	7881.7539	-3447.1177	317.8843	-217.9637	24.5142	24.5142
7	-95.7539	-360.7185	369.4749	-115.1640	10.3212	-12.0106	-1.0421	-1.0421
8	59.6558	538.5747	1057.1575	-125.0012	-6.0417	-0.2612	-0.0387	-0.0387
9	-354.6121	-115.1640	-12.0106	-0.2612	-0.0387	-0.0325	-0.0041	-0.0041
10	-354.6121	-115.1640	-12.0106	-0.2612	-0.0387	-0.0325	-0.0041	-0.0041
11	-354.6121	-115.1640	-12.0106	-0.2612	-0.0387	-0.0325	-0.0041	-0.0041
12	-354.6121	-115.1640	-12.0106	-0.2612	-0.0387	-0.0325	-0.0041	-0.0041
13	-354.6121	-115.1640	-12.0106	-0.2612	-0.0387	-0.0325	-0.0041	-0.0041
14	-354.6121	-115.1640	-12.0106	-0.2612	-0.0387	-0.0325	-0.0041	-0.0041
15	-354.6121	-115.1640	-12.0106	-0.2612	-0.0387	-0.0325	-0.0041	-0.0041

113.4488

VARIANCE-COVARIANCE MATRIX FOR COMPOSITION DATA

ROW	COL. 1	COL. 2	COL. 3	COL. 4	COL. 5	COL. 6	COL. 7	COL. 8
1	-422.7144	88.71144	-45.0156	-14.7864	-7.5254	12204.8239	-6.5012	-177.9335
2	-422.7144	88.71144	-45.0156	-14.7864	-7.5254	12204.8239	-6.5012	30562.2300
3	3.0156	-3.0156	3.0156	7.5254	-20.95203	-71.42324	-6.4835	-13.5210
4	3.0156	-3.0156	3.0156	7.5254	-20.95203	-71.42324	-6.4835	47.95208
5	-17.9335	17.9335	-17.9335	-1.6572	20.95203	189.77374	15.5777	47.95208
6	-17.9335	17.9335	-17.9335	-1.6572	20.95203	189.77374	15.5777	12870.5250
7	-17.9335	17.9335	-17.9335	-1.6572	20.95203	189.77374	15.5777	-43.5284
8	-17.9335	17.9335	-17.9335	-1.6572	20.95203	189.77374	15.5777	-202.4776
9	1357.5050	-1357.5050	1357.5050	1.6572	-20.95203	-189.77374	-15.5777	-1.4420
10	1357.5050	-1357.5050	1357.5050	1.6572	-20.95203	-189.77374	-15.5777	1.4420
11	3.7922	-3.7922	3.7922	-0.0572	0.0866	0.0277	0.0258	0.0002
12	3.7922	-3.7922	3.7922	-0.0572	0.0866	0.0277	0.0258	0.0002
13	3.7922	-3.7922	3.7922	-0.0572	0.0866	0.0277	0.0258	0.0002
14	3.7922	-3.7922	3.7922	-0.0572	0.0866	0.0277	0.0258	0.0002
15	3.7922	-3.7922	3.7922	-0.0572	0.0866	0.0277	0.0258	0.0002

CORRELATION MATRIX FOR COMPOSITION DATA

ROW	COL. 1	COL. 2	COL. 3	COL. 4	COL. 5	COL. 6	COL. 7	COL. 8
1	1.0000	0.7110	0.9577	0.4091	-0.5465	-0.8622	-0.9774	-0.5039
2	0.7110	1.0000	0.8331	0.1313	-0.9577	-0.9475	-0.9663	-0.5633
3	0.9577	0.8331	1.0000	0.7770	0.8378	0.8380	0.7432	0.7754
4	0.4091	0.1313	0.7770	1.0000	0.7643	0.7724	0.9620	0.7092
5	-0.5465	-0.9577	0.8378	0.7643	1.0000	0.9732	0.9691	-0.7891
6	-0.8622	-0.9475	0.8380	0.7724	0.9732	1.0000	0.8065	-0.5509
7	-0.9774	-0.9663	0.9620	0.9691	0.9691	0.8065	1.0000	-0.5205
8	-0.5039	-0.5633	0.7754	0.7092	-0.7891	-0.5509	-0.5205	1.0000
9	0.5039	0.5633	-0.7754	-0.7092	0.7891	0.5509	0.5205	-0.5205
10	0.5039	0.5633	-0.7754	-0.7092	0.7891	0.5509	0.5205	-0.5205
11	0.5039	0.5633	-0.7754	-0.7092	0.7891	0.5509	0.5205	-0.5205
12	0.5039	0.5633	-0.7754	-0.7092	0.7891	0.5509	0.5205	-0.5205
13	0.5039	0.5633	-0.7754	-0.7092	0.7891	0.5509	0.5205	-0.5205
14	0.5039	0.5633	-0.7754	-0.7092	0.7891	0.5509	0.5205	-0.5205
15	0.5039	0.5633	-0.7754	-0.7092	0.7891	0.5509	0.5205	-0.5205

VARIABLE (GNP) 2	VARIABLE 1 (DEFENSE EXPENDITURES)
1665.000	1665.000
1635.000	1635.000
1605.000	1605.000
1575.000	1575.000
1545.000	1545.000
1515.000	1515.000
1485.000	1485.000
1455.000	1455.000
1425.000	1425.000
1395.000	1395.000
1365.000	1365.000
1335.000	1335.000
1305.000	1305.000
1275.000	1275.000
1245.000	1245.000
1215.000	1215.000
1185.000	1185.000
1155.000	1155.000
1125.000	1125.000
1095.000	1095.000
1065.000	1065.000
1035.000	1035.000
1005.000	1005.000
975.000	975.000
945.000	945.000
915.000	915.000
885.000	885.000
855.000	855.000
825.000	825.000
795.000	795.000
765.000	765.000
735.000	735.000
705.000	705.000
675.000	675.000
645.000	645.000
615.000	615.000
585.000	585.000
555.000	555.000
525.000	525.000
495.000	495.000
465.000	465.000
435.000	435.000
405.000	405.000
375.000	375.000
345.000	345.000
315.000	315.000
285.000	285.000
255.000	255.000
225.000	225.000
195.000	195.000
165.000	165.000

VARIABLE (GNP)		VARIABLE 1 (DEFENSE EXPENDITURES AS % OF GNP)											
2		2.475	3.225	3.975	4.725	5.475	6.225	6.975	7.725	8.475	9.225	9.975	
1665.000	+	+	+	+	+	+	+	+	+	+	+	+	
1635.000	.	.	.	.	.	.	.	.	.	.	.	.
1605.000	.	.	.	.	.	.	.	.	.	.	.	.
1575.000	.	.	.	.	.	.	.	.	.	.	.	.
1545.000	.	.	.	.	.	.	.	.	.	.	.	.
1515.000	+	+	+	+	+	+	+	+	+	+	+	+	
1485.000	.	.	.	.	.	.	.	.	.	.	.	.
1455.000	.	.	.	.	.	.	.	.	.	.	.	.
1425.000	.	.	.	.	.	.	.	.	.	.	.	.
1395.000	.	.	.	.	.	.	.	.	.	.	.	.
1365.000	+	+	+	+	+	+	+	+	+	+	+	+	
1335.000	.	.	.	.	.	.	.	.	.	.	.	.
1305.000	.	.	.	.	.	.	.	.	.	.	.	.
1275.000	.	.	.	.	.	.	.	.	.	.	.	.
1245.000	.	.	.	.	.	.	.	.	.	.	.	.
1215.000	+	+	+	+	+	+	+	+	+	+	+	+	
1185.000	.	.	.	.	.	.	.	.	.	.	.	.
1155.000	.	.	.	.	.	.	.	.	.	.	.	.
1125.000	.	.	.	.	.	.	.	.	.	.	.	.
1095.000	.	.	.	.	.	.	.	.	.	.	.	.
1065.000	+	+	+	+	+	+	+	+	+	+	+	+	
1035.000	.	.	.	.	.	.	.	.	.	.	.	.
1005.000	.	.	.	.	.	.	.	.	.	.	.	.
975.000	1	1	1	1	1	1	1	1	1	1	1	1	
945.000	.	.	.	.	.	.	.	.	.	.	.	.
915.000	+	+	+	+	+	+	+	+	+	+	+	+	
885.000	.	.	.	.	.	.	.	.	.	.	.	.
855.000	.	.	.	.	.	.	.	.	.	.	.	.
825.000	.	.	.	.	.	.	.	.	.	.	.	.
795.000	.	.	.	.	.	.	.	.	.	.	.	.
765.000	.	.	.	.	.	.	.	.	.	.	.	.
735.000	+	+	+	+	+	+	+	+	+	+	+	+	
705.000	.	.	.	.	.	.	.	.	.	.	.	.
675.000	.	.	.	.	.	.	.	.	.	.	.	.
645.000	.	.	.	.	.	.	.	.	.	.	.	.
615.000	+	+	+	+	+	+	+	+	+	+	+	+	
585.000	.	.	.	.	.	.	.	.	.	.	.	.
555.000	.	.	.	.	.	.	.	.	.	.	.	.
525.000	.	.	.	.	.	.	.	.	.	.	.	.
495.000	.	.	.	.	.	.	.	.	.	.	.	.
465.000	+	+	+	+	+	+	+	+	+	+	+	+	
435.000	.	.	.	.	.	.	.	.	.	.	.	.
405.000	.	.	.	.	.	.	.	.	.	.	.	.
375.000	.	.	.	.	.	.	.	.	.	.	.	.
345.000	.	.	.	.	.	.	.	.	.	.	.	.
315.000	+	+	+	+	+	+	+	+	+	+	+	+	
285.000	.	.	.	.	.	.	.	.	.	.	.	.
255.000	.	.	.	.	.	.	.	.	.	.	.	.
225.000	.	.	.	.	.	.	.	.	.	.	.	.
195.000	.	.	.	.	.	.	.	.	.	.	.	.
165.000	+	+	+	+	+	+	+	+	+	+	+	+	

VARIABLE 1 OF BASIC DATA (DEFENSE EXPENDITURES vs. YEAR)



X-SCALE: "X" = 0.212E 00 UNITS
Y-SCALE: "Y" = 0.296E 00 UNITS

TABLE 2 OF BASIC DATA (GNP vs. YEAR)



X-SCALE: "X" = 0.212E 00 UNITS
Y-SCALE: "Y" = 0.167E 02 UNITS

VARIABLE 1 OF COMPOSITION: DATA (DEFENSE EXPENDITURES AS % OF GNP vs. YEAR)



X-SCALE: "X" = 0.212E 00 UNITS

Y-SCALE: "Y" = 0.104E 00 UNITS

MULTIPLE REGRESSION.....ORIGIN

SELECTION..... 3

VARIABLE NO.	MEAN	STANDARD DEVIATION	CORRELATION X VS Y	REGRESSION COEFFICIENT	STD. ERROR OF REG. COEF.	COMPUTED T VALUE
2	742.01074	298.02808	0.56521	0.10239	0.04488	2.28119
3	78.54155	19.76717	0.64301	0.63821	0.22884	2.78838
4	610.88232	202.93341	0.51309	-0.19297	0.05833	-3.30821
5	151.76271	130.84129	0.71059	-0.00717	0.03680	-0.19496
DEPENDENT I	33.61548	5.29526				

INTERCEPT	26.48509
MULTIPLE CORRELATION	0.93286
STD. ERROR OF ESTIMATE	2.18139

ANALYSIS OF VARIANCE FOR THE REGRESSION

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARES	F VALUE
ATTRIBUTABLE TO REGRESSION	4	414.81714	103.70428	21.79370
DEVIATION FROM REGRESSION	13	61.85986	4.75845	
TOTAL	17	476.67700		

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13. ABSTRACT

The huge size of the Korean defense budget and its armed forces have created a need for an operational analysis. It is shown through a multivariate statistical analysis what some of the opportunity costs of defense spending have been.

The Korea-U. S. alliance is discussed emphasizing developmental effects of U. S. aid.

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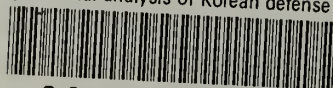
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